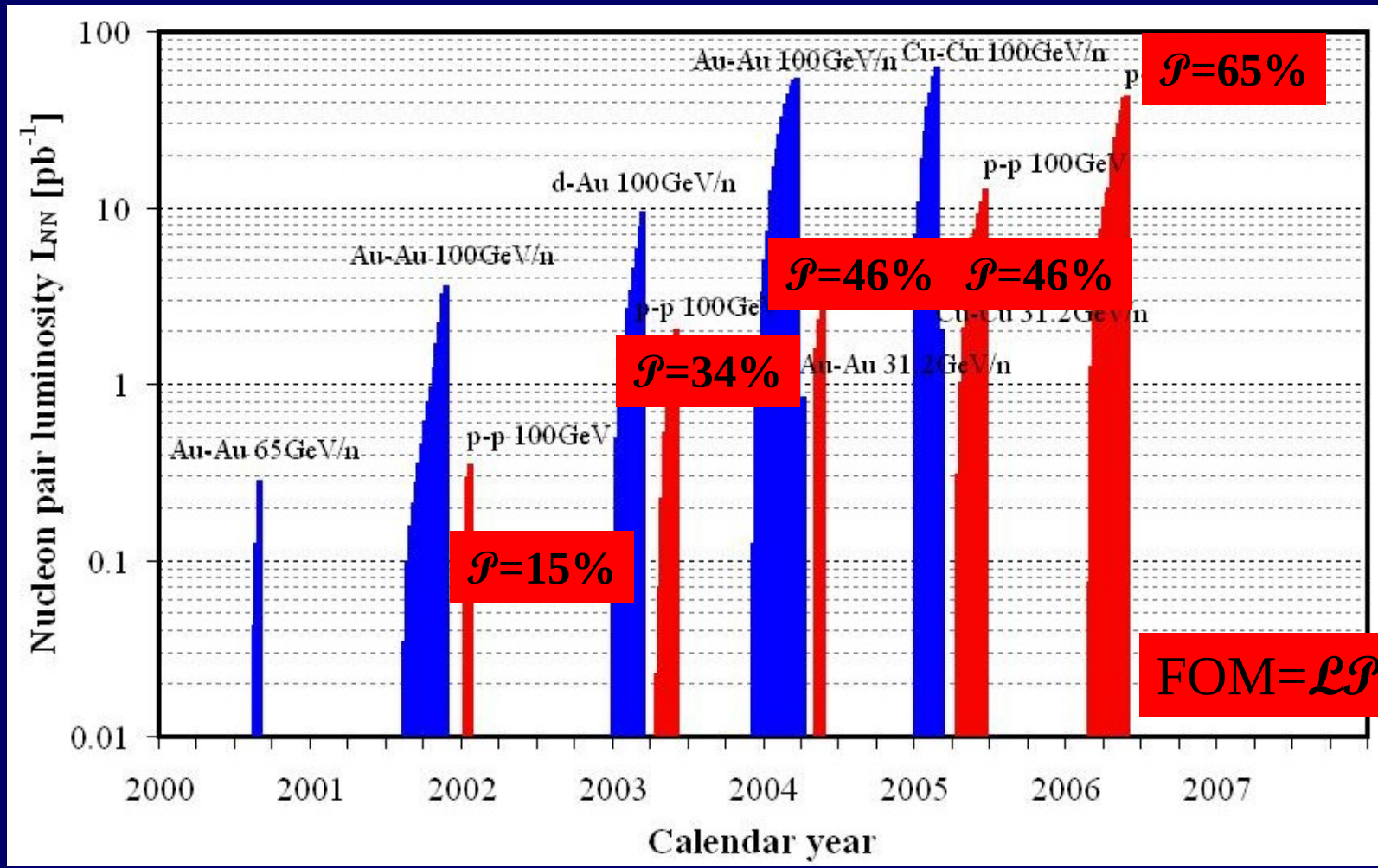
Enhanced RHIC Task Force

RHIC Retreat, Port Jefferson, 10 July 2006

Luminosity and polarization

Delivered luminosity increased by 2 orders of magnitude in 5 years.



Delivered to PHENIX.

Enhanced Design Parameters

1. Au-Au $\mathcal{L}_{\text{store avg}} = 8\times10^{26}\text{cm}^{-2}\text{s}^{-1}$ at 100 GeV/n
2. p↑-p↑ $\mathcal{L}_{\text{store avg}} = 150\times10^{30}\text{cm}^{-2}\text{s}^{-1}$ at 250 GeV
3. $\mathcal{P}_{\text{store avg}} = 70\%$
4. 60% of calendar time in store = 100h/week

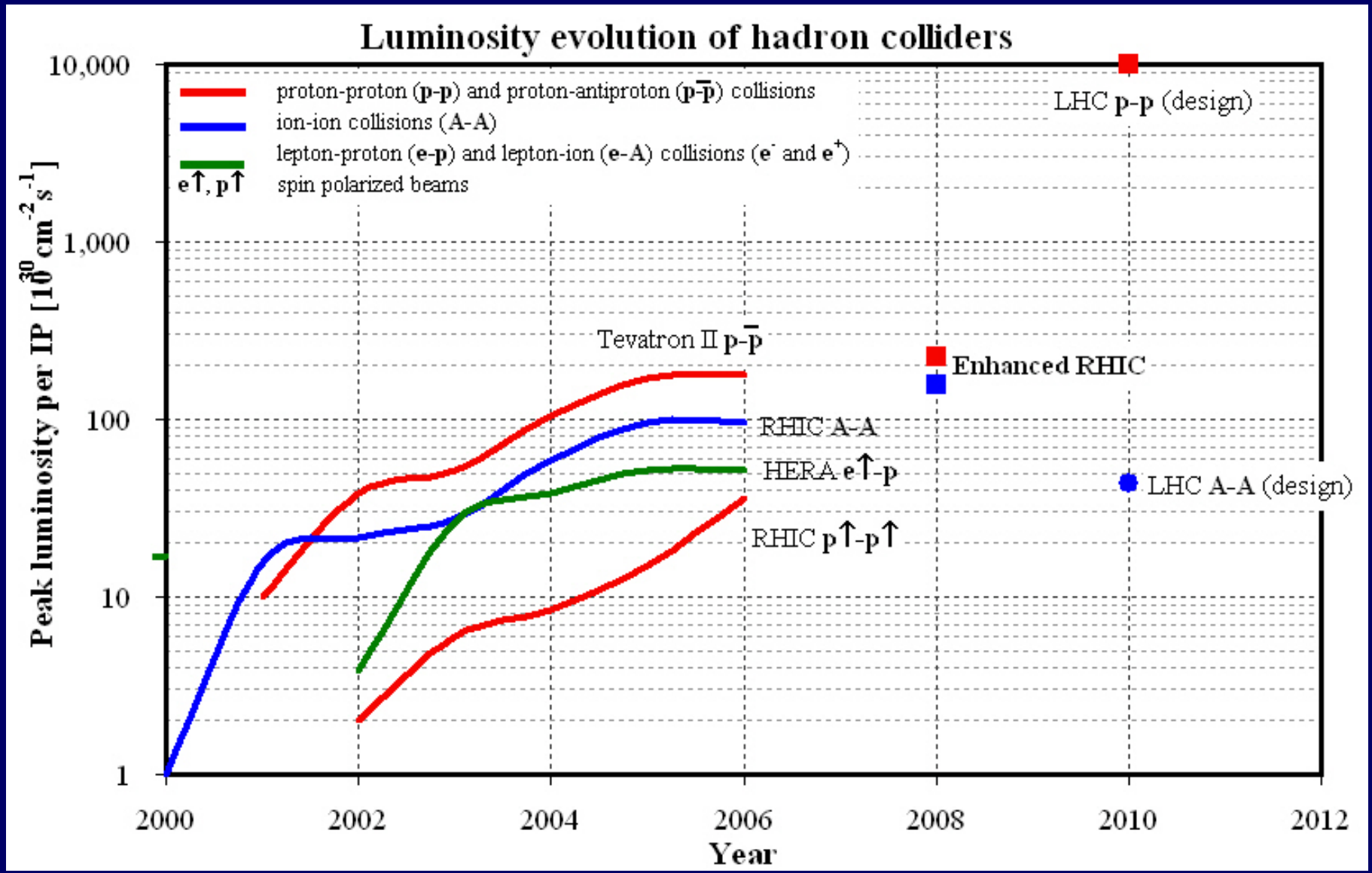
Enhanced Design Parameters (~2008*)

Parameter	unit	Achieved	Enhanced design	
Au-Au operation				
Energy	GeV/n	100	100	
No of bunches	…	45	111	
Bunch intensity	10^9	1.1	1.0	
Average $\mathcal{L}$	**10^{26}cm^{-2}s^{-1}**	**5**	**8**	← **1.6×**
p↑- p↑ operation				
Energy	GeV	100	250	
No of bunches	…	111	111	
Bunch intensity	10^{11}	1.4	2.0	
Average $\mathcal{L}$	**10^{30}cm^{-2}s^{-1}**	**20**	**150**	← **7.5×**
Polarization $\mathcal{P}$	**%**	**65**	**70**	← **+5%**

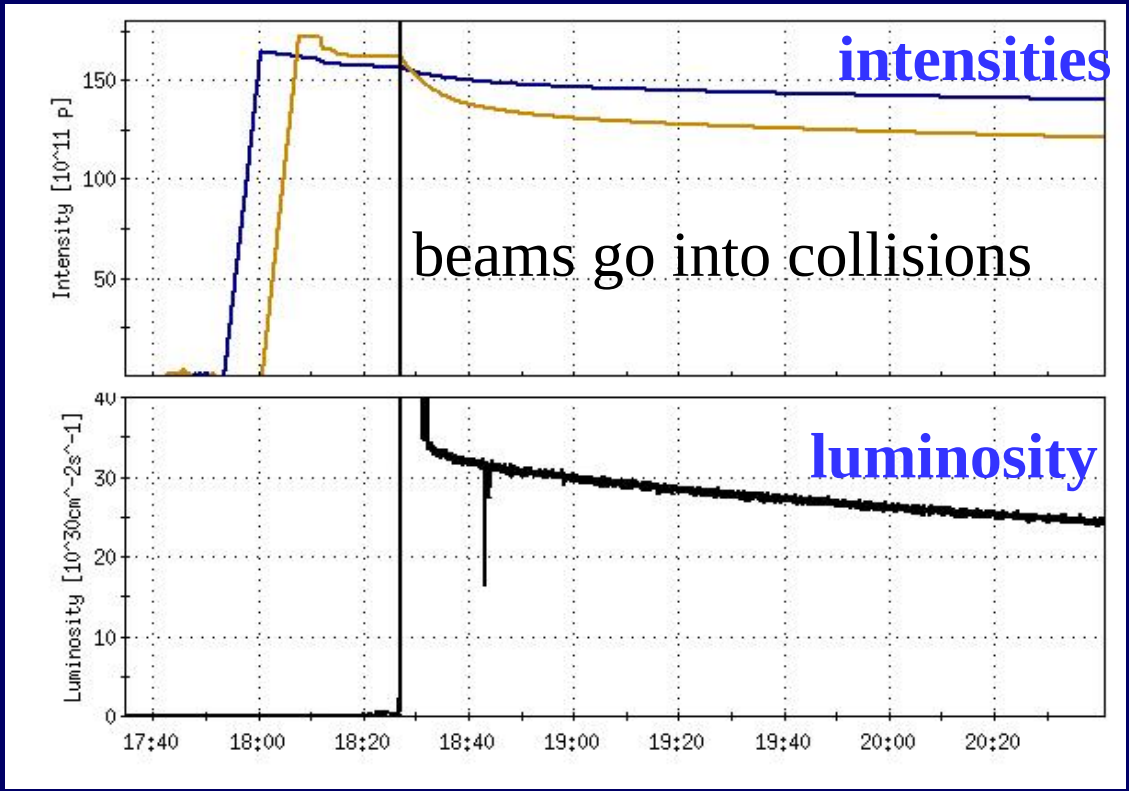
Should be possible in next Au-Au run

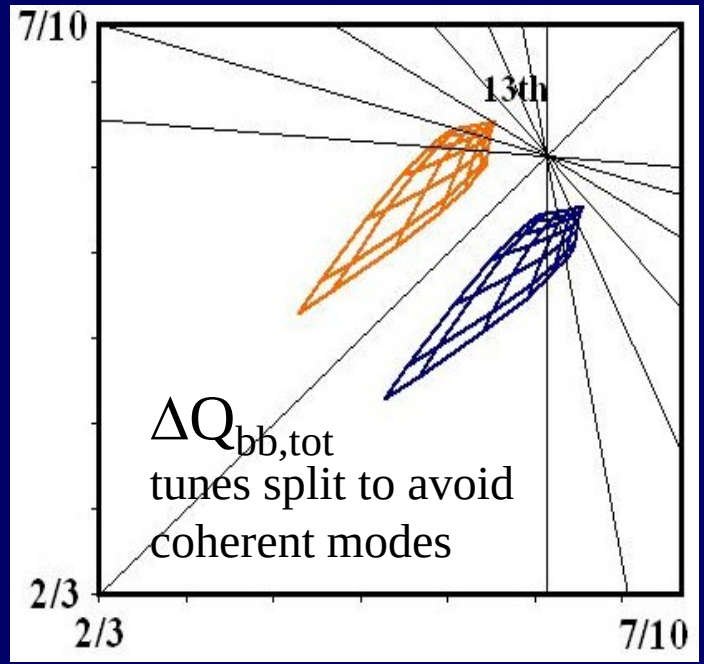
* First 250 GeV p↑-p↑ physics run currently scheduled for 2009.

Enhanced Design Parameters (~2008)



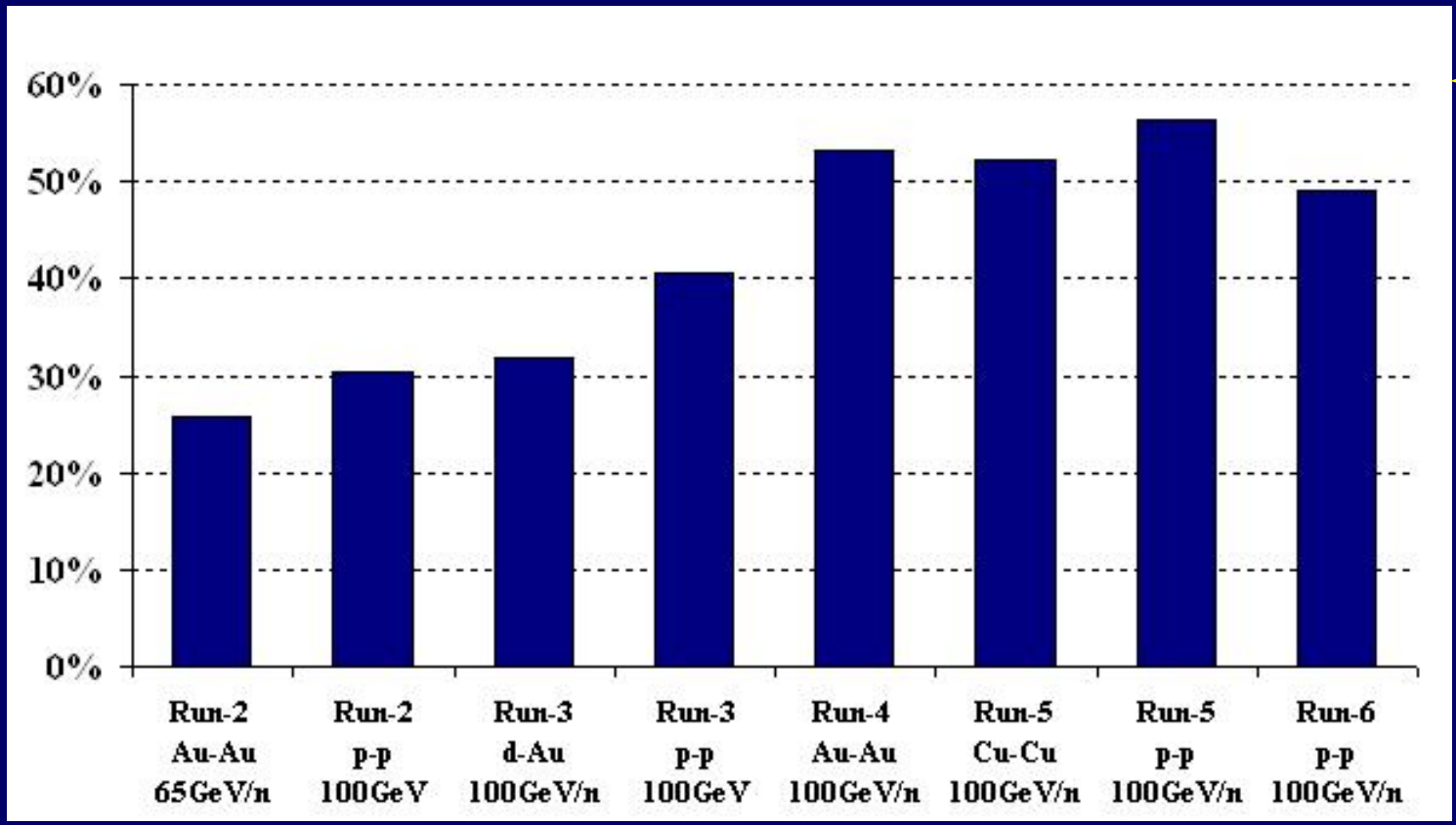
Performance limit: beam-beam for p↑- p↑





- Total beam-beam induced tune spread reached $\Delta Q_{bb,tot} = 0.012$
- Other sources of tune spread: $\Delta Q \approx 0.005$
  - nonlinear chromaticity (correction planned for next year)
  - triplet errors (locally corrected)
- Sources for orbit and tune modulation

Calendar time in store after setup



goal 100h/week

Rest of the time:

~20% machine tuning/ramping

~15% failures

~10% machine development and accelerator physics experiments

Summary I

Run-7 goals:

1. **Au-Au** $\mathcal{L}_{\text{store avg}} = 8\times10^{26}\text{cm}^{-2}\text{s}^{-1}$ → **Reach**
2. **p↑-p↑** $\mathcal{L}_{\text{store avg}} = 150\times$ → **$40\times10^{30}\text{cm}^{-2}\text{s}^{-1}$ at 100 GeV**
3. $\mathcal{P}_{\text{store avg}} = 70\%$ → **Reach?**
4. **60% of calendar time in store** → **Reach with Au-Au**

- 2× Run-6
- Need 50% increase in Run-8
- Energy from 100 to 250 GeV in Run-9

Summary II

- Next Au-Au Run:

  → **Operate RHIC like a "QGP factory"**

- Next p↑-p↑ Runs:

  → **Operate to maximize $\mathcal{L}$ and $\mathcal{P}$ increases**